



CLEAN ENERGY FROM RIVER NILE

The Bulb Units for **NEW NAGA HAMMADI**

A Case Study

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Case Study - NEW NAGA HAMMADI Hydroelectric Project

- The river Nile has always been the axis of prosperity for Egypt
- The barrage at Naga Hammadi is one of the three structures on the River Nile which control the water levels for some distance upstream.
- Waterpower use has been very diligently integrated with irrigation and flood control purposes
- The first Barrage and Power plant in Naga Hammadi had already been equipped in 1937 with three vertical Kaplan turbines.



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- All Nile dams below Aswan have low head (little difference between reservoir and downstream level)
- Low Head Power stations in general have lowest environmental and social impact
- Necessary rehabilitation and reconstruction of existing dam structures is utilized to provide additional clean and renewable energy



Old Naga Hammadi Dam



New Naga Hammadi
(Foto: Bilfinger & Berger)

ANDRITZ

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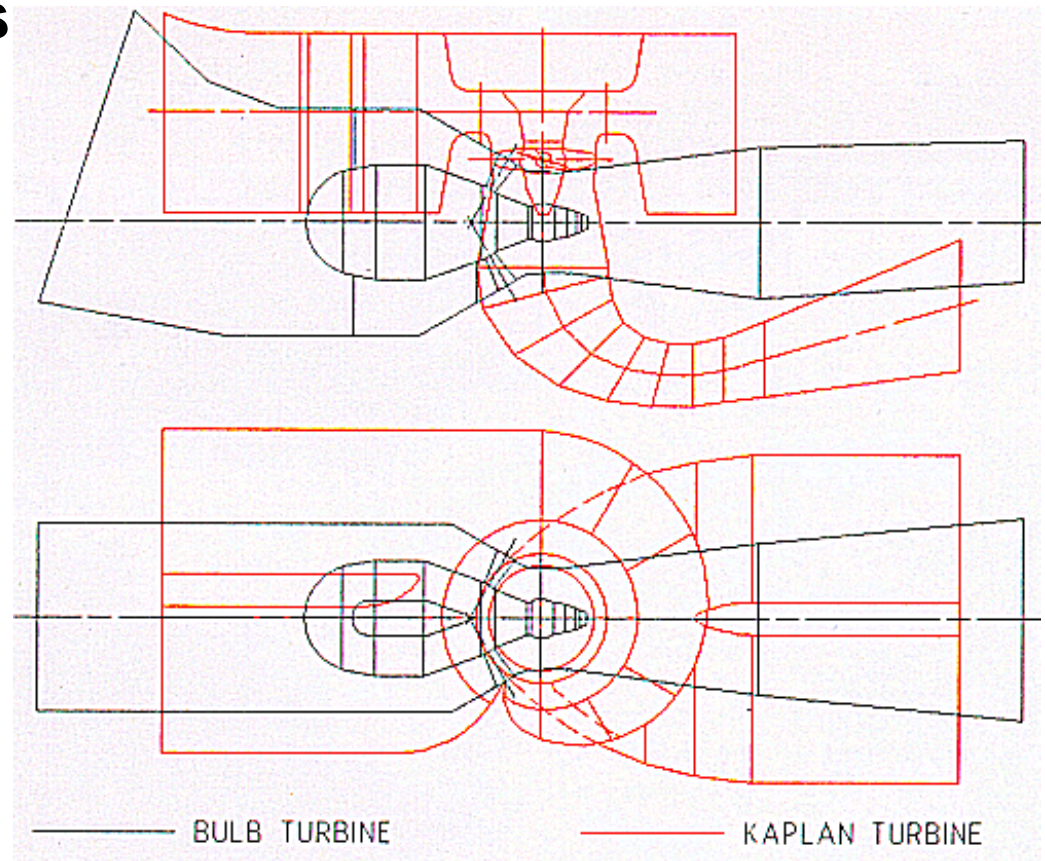
- **The old NAGA HAMMADI weir was built 1927 – 1930. To ensure irrigation, it is presently replaced by a new dam**
- **The new dam will also serve as bridge over the river Nile**
- **Integrated in the new dam, a powerhouse is built with 4 large bulb units**
- **The power plant will generate more than 500 GWh of environmental friendly, CO2 free domestic electricity, sufficient for approx. 200.000 homes**



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CHOICE OF BASIC TURBINE CONCEPT

- The head varies between 4m and 8 m. The discharge varies from 175 m³/s to 417 m³/s
- Due to low space requirement and excellent past experience (upstream New Esna), there was no doubt about selecting bulb units
- Double regulation was chosen to grant high efficiencies over a wide operating range



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HIGH QUALITY APPROACH

- **The power station is intended to serve on a long term basis for reliable power supply to the people of the Nile valley**
- **Therefore, special attention is given to experience and quality of the selected suppliers**
- **Sourcing possibilities are strictly limited to highly experienced first class manufacturers, not only for coordination and project management but also for workshop activities**
- **Long term experience with manufacturing of similar parts was strictly requested, without any room for interpretation**



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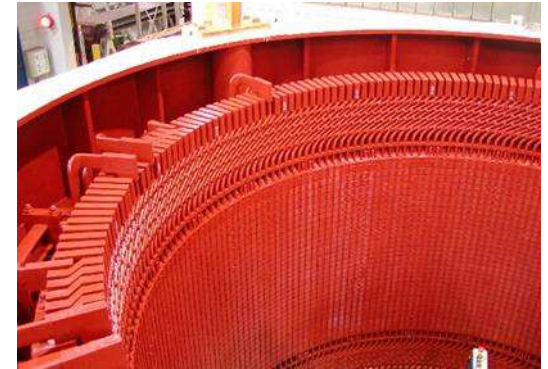
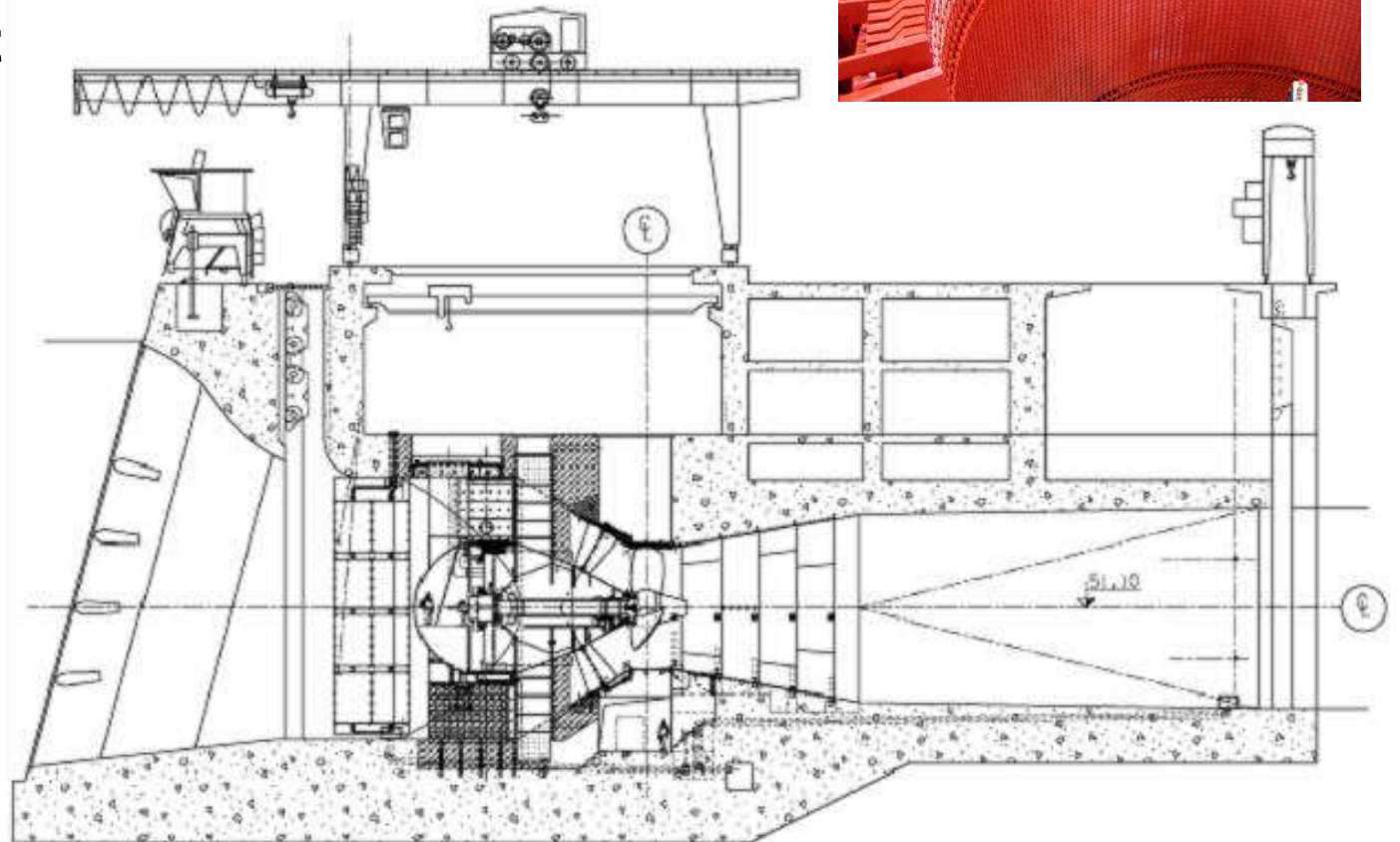
TECHNICAL MAIN DATA - 4 units

$D1 = 6800 \text{ mm}$

$P = 20 \text{ MW / unit}$

$n = 71,4 \text{ rpm}$

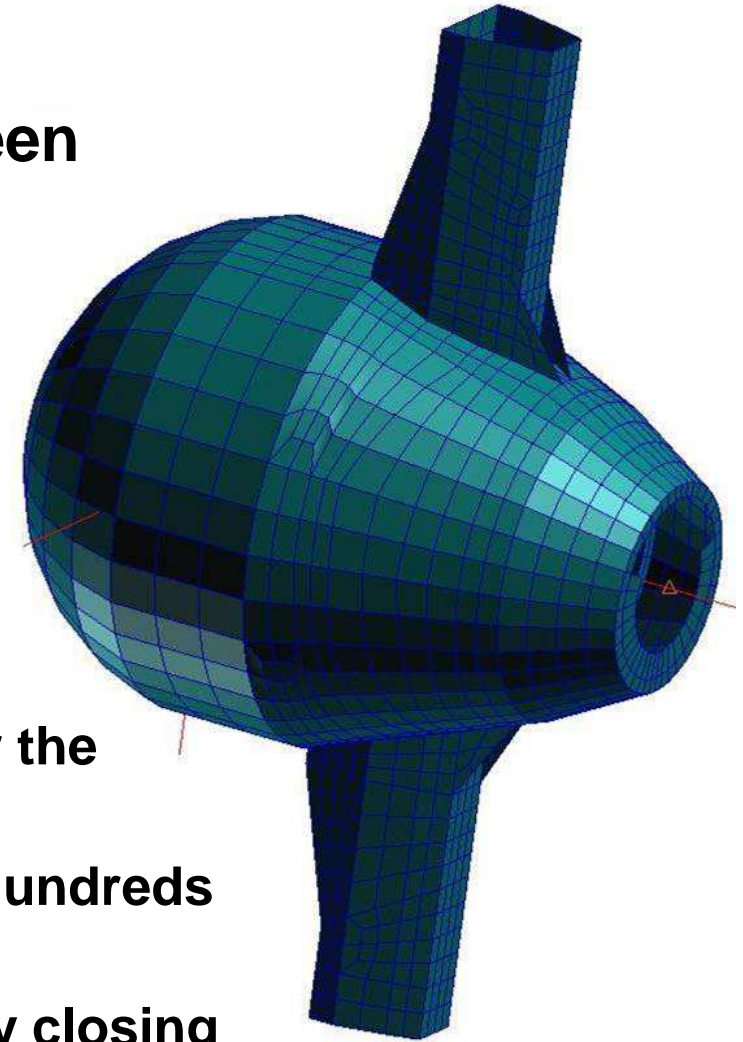
$H_{\text{max}} = 8,5 \text{ m}$



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SELECTED DESIGN FEATURES

- **Stability of the bulb structure has been proven thoroughly**
- **Three bladed runner design, full model test with superb performance at a wide range of operation**
- **Focus on easy maintenance and environmental friendly design**
 - Self lubricated, greaseless bushings for the distributor
 - Reliable Runner blade seals proven in hundreds of units
 - Closing weight granting safe emergency closing



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GENERATOR CHARACTERISTICS

- Generator with 71,4 rpm = 84 poles, 11 kV, stacked in the workshop in Weiz / Austria
- Combined thrust and guide bearing close to the rotor
- Closed cooling system for operation independent of sand and pollution in the water



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SUMMARY AND OUTLOOK

- This type of project has very low impact regarding social and environmental aspects (very small inundated area)
- High quality approach guarantees not only a timely project execution, but also a carefree operation in the future.
- There are several other similar low head power projects in Africa which will help to increase renewable energy production (e.g. Damietta, Assiut / Egypt, Felou / Mali etc.)

*A low head “run of river plant” using modern bulb units
is embedded ideally into the natural cycle
of sun and water*

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**THANK YOU FOR YOUR
ATTENTION**